IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: William B. Kerfoot	Art Unit	: Unknown
Serial No.	: Continuation of 09/606,952	Examiner	: Unknown
Filed	:		
Title	: MICROPOROUS DIFFUSION APPARATUS		

Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Please enter this Preliminary Amendment as follows:

In the Specification:

Please add before the first line of the specification the following:

This application is a continuation application of application serial no. 09/606,952 filed June 29, 2000 (allowed US Patent No. 6284143) which was a continuation of U.S. application serial no. 09/220,401, filed December 24, 1998 (allowed US Patent 6,083,407), which is a continuation of U.S. application serial no. 08/756,273, filed November 25, 1996 (allowed US Patent 5,855,775) which was a continuation-in-part of application Serial No. 08/638,017 filed on April 25, 1996 (abandoned) which was a continuation-in-part of application Serial No. 29/038,499 filed on May 5, 1995 (abandoned). The disclosure of the prior applications are considered part of and are incorporated by reference in the disclosure of this application.

In the Claims:

Please cancel claims 1-8.

CERTIFICATE OF MAILING BY EXPRESS MAIL

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I hereby certify under 37 CFR §1.10 that this correspondence is being deposited with the United States Postal Service as Express Mail Post Office to Addressee with sufficient postage on the date indicated below and is addressed to the Commissioner for Patents, Washington, D.C 20231.

August 30 2001
Date of Deposit

Samantha Bell
Signature

Samantha Bell
Typed or Printed Name of Person Signing Certificate

Please add claims 9-25, as follows.

9. A method for removal of contaminants in a soil formation comprises:

supplying ambient air and ozone at concentrations to effect removal of the contaminants;

producing microbubbles containing the ambient air and ozone at concentrations to effect removal of contaminants; and

introducing the microbubbles containing the ambient air and ozone at concentrations to effect removal of contaminants into the soil formation under conditions that contaminants in a dissolved state in the soil formation are pulled out of the soil formation through the microbubbles and are provided in a vapor state within the microbubbles to react with the ozone contained in the microbubbles in accordance with Henry's law.

10. The method of claim 9 wherein the microbubbles are sized in accordance with a porosity characteristic of the soil formation.

11. The method of claim 9 wherein introducing further comprises:

providing a plurality of injection wells to introduce the microbubbles containing the ambient air and ozone.

12. The method of claim 11 wherein introducing further comprises:

using a plurality of microporous diffusers in the plurality of injection wells to introduce the microbubbles containing the ambient air and ozone.

13. The method of claim 9 wherein the soil formation contaminants with a Henry's constant in the order of about 2.59×10^{-2} to 4.48×10^{-5}.

14. The method of claim 9 wherein contaminants in the soil formation are decomposed by ozone interaction in the bubbles with the contaminants.

15. The method of claim 9 wherein the fine bubbles have an initial bubble size at least between about 5 to 200 microns.

16. A method for removal of contaminants in a soil formation comprises:

providing a plurality of injection wells and introducing ambient air and ozone as microbubbles through the injection wells by using a corresponding micro-porous diffuser for each one of the plurality of injection wells;

surrounding the micro-porous diffusers with a sand pack disposed between the micro-porous diffusers and the surrounding soil formation; and

introducing ambient air and ozone as microbubbles by using micro-porous diffusers in the injection wells under conditions that moist soils promote contaminants that exist in a dissolved state in the soil formation to be pulled out of the soil formation through membranes of the microbubbles and react in a vapor state within the microbubbles with the ozone contained in the microbubbles.

17. The method of claim 16 wherein the microbubbles increase the lifetime of ozone in the soil formation.

18. The method of claim 16 wherein removal of contaminants can occur without a vapor extraction.

19. The method of claim 16 further comprising pulsing a water phase to provide steady upward migration of the micro-fine bubbles through the soil formation.

20. The method of claim 16 wherein the soil formation contains chlorinated hydrocarbons.

21. The method of claim 16 wherein the soil formation contains chlorinated ethenes.

22. The method of claim 16 wherein the contaminants include chlorinated ethenes including dichloroethene, trichloroethene, and/or tetrachloroethene.

23. The method of claim 16 wherein the micro-porous diffusers have a pore size

between about 5 to 200 microns to provide the fine bubbles.

24. The method of claim 16 wherein the micro-porous diffusers have a pore size selected to match a porosity characteristic of the surrounding soil formation.

25. The method of claim 16 wherein the micro-porous diffusers have a pore size selected to match a porosity characteristic and a permeability characteristic of the surrounding soil formation.

REMARKS

Applicant has filed this continuation application in order to have additional patentable subject matter examined and considered.

Applicant has also enclosed a copy of the informal drawings that were originally filed in the prior application, and a copy of the formal drawings that were filed in the patent application in response to the Notice of Allowance. Thus, this case has been filed with formal drawings.

Respectfully submitted,

Date: 8/30/2001

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FIG. 1

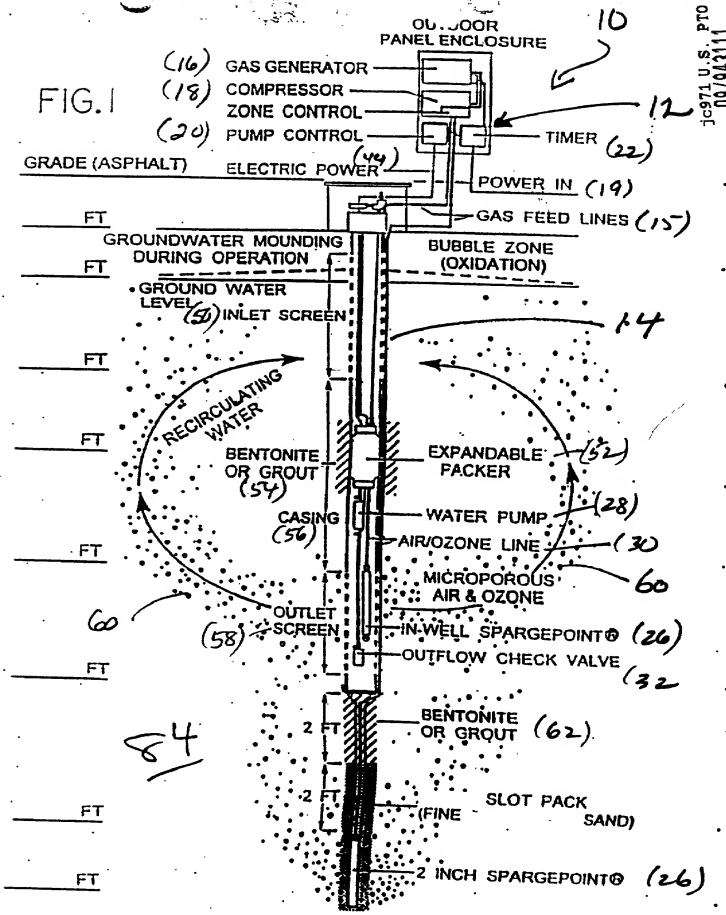
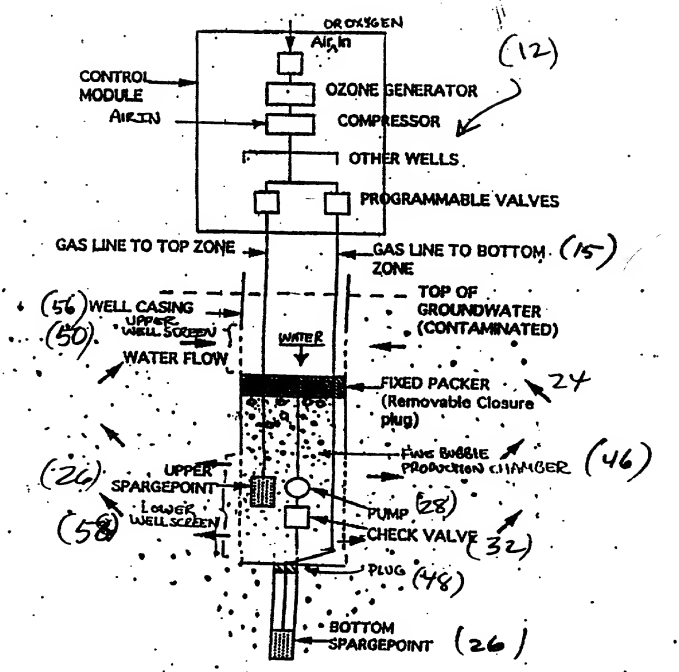


FIGURE 2


OXYGEN
Air In
(12)
CONTROL MODULE
AIR IN
OZONE GENERATOR
COMPRESSOR
OTHER WELLS
PROGRAMMABLE VALVES
GAS LINE TO TOP ZONE
GAS LINE TO BOTTOM ZONE
(15)
(56) WELL CASING
TOP OF GROUNDWATER (CONTAMINATED)
(50) UPPER WELL SCREEN
WATER FLOW
WATER
FIXED PACKER (Removable Closure plug)
24
FINE BUBBLE PRODUCTION CHAMBER
(46)
(26) UPPER SPARGEPOINT
(58) LOWER WELL SCREEN
PUMP
(28)
CHECK VALVE
(32)
PLUG
(48)
BOTTOM SPARGEPOINT
(26)

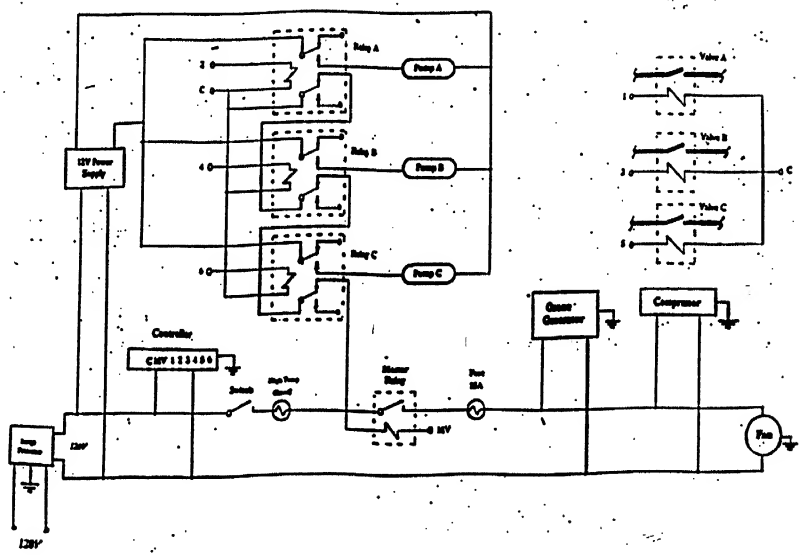
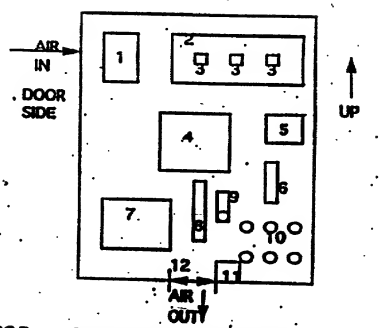

Relay A
Relay B
Relay C
Pump A
Pump B
Pump C
12V Power Supply
Valve A
Valve B
Valve C
Controller
Motor Relay
Gas Generator
Compressor
Fan
120V

FIGURE 3

FIGURE 4



71 AC to DC Power Converter(or trickle charged lead acid battery)

72 Ozone Generator

73 Well Gas Relays (3 wells shown)

74 Compressor

75 Master Relay

76 T5 A Main Fuse

77 Programmable Timer-Controller

78 Power Strip

79 Gas Regulator & Pressure Gage

80 Solenoid Manifold(Number depends on Series & Number wells)

81 Ground Fault Interruptor

82 Cooling Fan

FIGURE 5 A

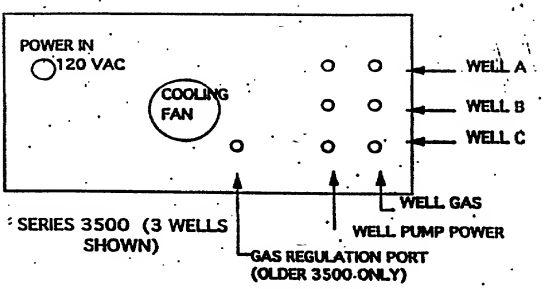


FIG. 5B

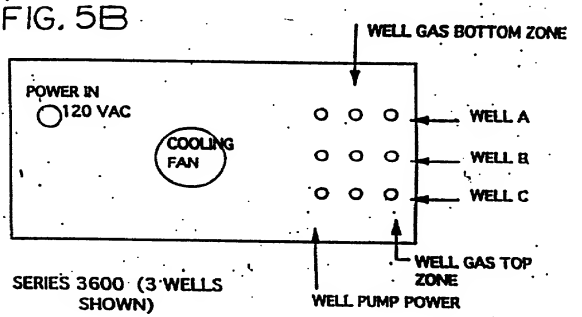
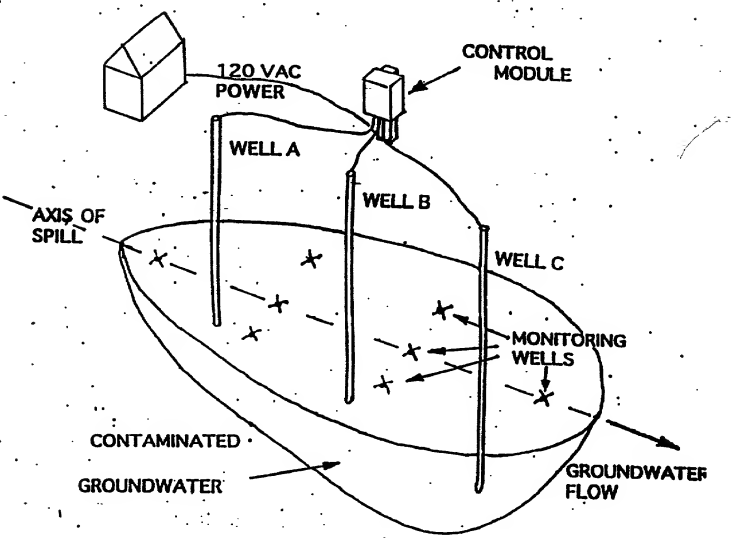


FIGURE 6 C-SPARGER TM SYSTEMS - TYPICAL REMEDIATION SYSTEM CONFIGURATION



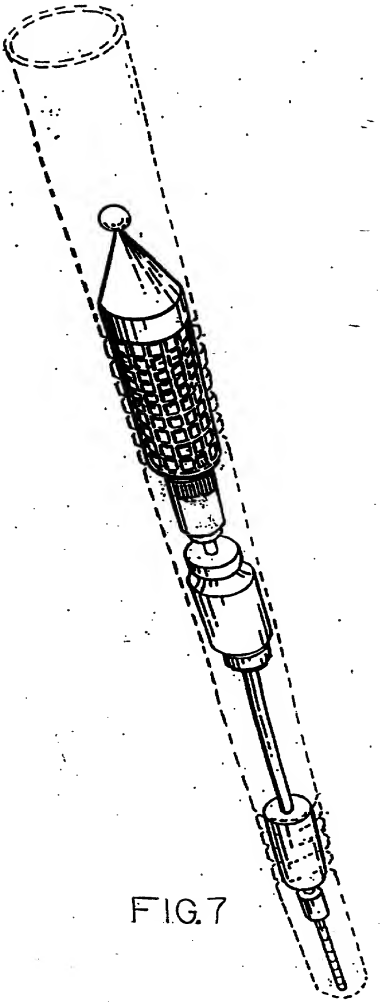


FIG. 7

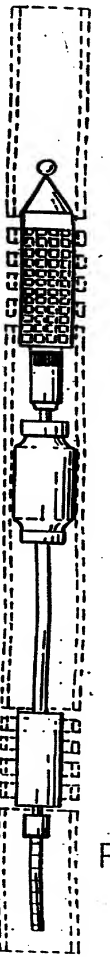


FIG. 8

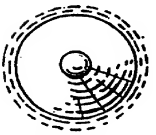


FIG. 9

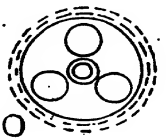


FIG. 10

FIG. 11

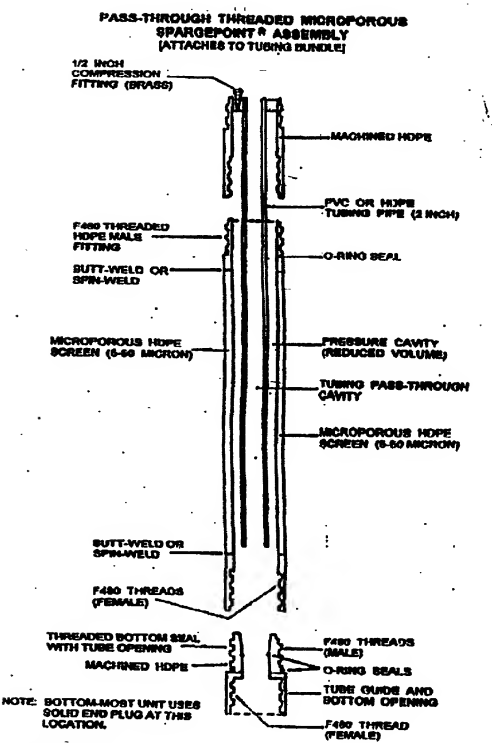

PASS-THROUGH THREADED MICROPOROUS
SPARGEPOINT® ASSEMBLY
(ATTACHES TO TUBING BUNDLE)
1/2 INCH
COMPRESSION
FITTING (BRASS)
MACHINED HDPE
PVC OR HDPE
TUBING PIPE (2 INCH)
F480 THREADED
HDPE MALE
FITTING
O-RING SEAL
BUTT-WELD OR
SPIN-WELD
MICROPOROUS HDPE
SCREEN (6-50 MICRON)
PRESSURE CAVITY
(REDUCED VOLUME)
TUBING PASS-THROUGH
CAVITY
MICROPOROUS HDPE
SCREEN (6-50 MICRON)
BUTT-WELD OR
SPIN-WELD
F480 THREADS
(FEMALE)
THREADED BOTTOM SEAL
WITH TUBE OPENING
MACHINED HDPE
F480 THREADS
(MALE)
O-RING SEALS
TUBE GUIDE AND
BOTTOM OPENING
F480 THREAD
(FEMALE)
NOTE: BOTTOM-MOST UNIT USES
SOLID END PLUG AT THIS
LOCATION.
DRAWN BY W.B.K., 11/2/98

FIG. 12

TABLE 1 C-SPARGER ™
MODEL SERIES 3500 & 3600 SPECIFICATIONS

	3500 Series	3600 Series
CONTROL MODULE		
External Power	120V AC,15 amp	120V AC,15 amp
Well pumps Power	12V DC, power converter *	12V DC, power converter *
compressor	3/4 hp (not for continuous service)	3/4 hp (continuous OK)
Ozone Generator	ATS-250	VCX-2
Gas tubing	1/4 in.	3/8 in.
Box Size	28"x 20 x11"	33"x 25 x 12"
Approx. Wt Control Mod.	73 lbs (M-3503)	100 lbs (M-3603)
Pump/gas Line Length (1 for each well)	100 ft.	100 ft
IN-WELL UNIT (Each well)		
Fixed Packer	4-6 in.	4-6 in.
Spargepoint ™ Top	1 in.	1 in.
Bottom	2 in.	—
Water Pump	XP-30ft	XP-30 ft.
Inlet & outlet Screens	10-20 slots/ft	10-20 slots/ft
Check valve, water	one, 1/4 in.	one, 1/4 in.
Timer/Controller	PSCZ-600Z	PSCZ-900Z

* current production, earlier units used a trickle charged lead acid battery

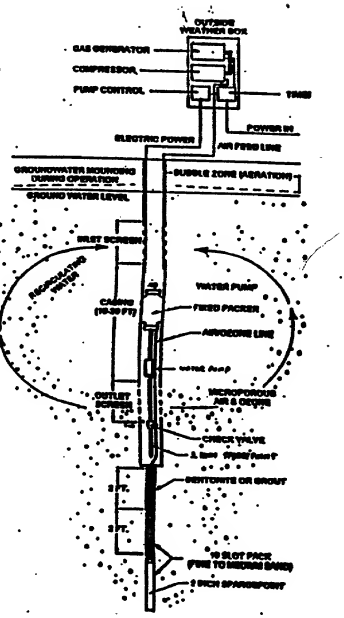


FIG. 13